Cadmium Rulemaking Hearing
Regulation Nos. 31 -38

December 9, 2019 Denver, CO

Introduction

- **First rulemaking for a 10-Year Water Quality Roadmap parameter**
  - Statewide approach
- **Outreach through the roadmap workgroup**
- **Technical Advisory Committee worked through technical topics**

Current Cadmium Standards

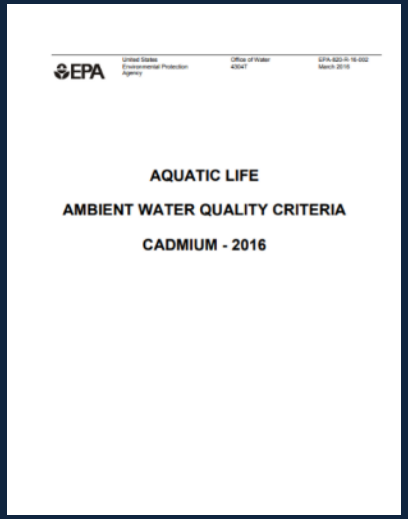
- **Colorado's current cadmium TVS for the protection of aquatic life include two acute standards and one chronic standard**
  - Hardness-based equations
- **The two acute standards protect two aquatic life communities**
  - Waters without trout [acute]
  - Waters with trout [acute(trout)]
- **These TVS were adopted in June 2005**
  - Updated EPA's 2001 cadmium criteria with new toxicity data

Duration	Equation*	Standard (µg/L) at Hardness (mg/L)	
		25	400
Acute	$cf_a * e^{(0.9151[\ln(\text{hardness})]-3.1485)}$	0.82	9.15
Acute(trout)	$cf_a * e^{(0.9151[\ln(\text{hardness})]-3.6236)}$	0.51	5.69
Chronic	$cf_c * e^{(0.7998[\ln(\text{hardness})]-4.4451)}$	0.15	1.20

Cf_a = 1.136672-[(ln(hardness))(0.041838)]
Cf_c = 1.101672-[(ln(hardness))*(0.041838)]

EPA 2016 Updated Criteria

- EPA released updated recommended 304(a) criteria for cadmium in March 2016
- This update incorporated new toxicity data that had become available since the criteria were last updated in 2001
- Acute criterion is lowered to protect sensitive cold water species (i.e., trout)
  - Like Colorado's current acute(trout) TVS
  - Goal of national criteria is to be protective of all aquatic life
- Hardness-based, just like our current TVS



EPA 2016 Updated Criteria

- **How is the acute criterion "lowered" to protect trout?**
- **Acute criteria are intended to "protect 95% of a group of diverse genera, unless a commercially or recreationally important species is very sensitive"**
- **EPA criteria calculation methods involve calculation of a Final Acute Value:**

  "estimate of the concentration of the material corresponding to a cumulative probability of 0.05 in the acute toxicity values for the genera with which acceptable acute tests have been conducted on the material."

EPA 2016 Updated Criteria

- **However, there may be cases where a species' acute threshold is lower than the Final Acute Value. In these situations, EPA methods suggest lowering the Final Acute Value to be more protective:**

  "However, in some cases, if the Species Mean Acute Value of a commercially or recreationally important species is lower than the calculated Final Acute Value, then that Species Mean Acute Value replaces the calculated Final Acute Value in order to provide protection for that important species."

- **That is the case with acute cadmium**
- **Most salmonid species (and other cold water species) are particularly acutely sensitive**

EPA 2016 Updated Criteria

Rainbow trout acute value is lower than the Final Acute Value of 5.734 µg/L

Genus	Species	SMAV	GMAV	Rank
Salvelinus	confluentus	4.191	4.191	1
Salvelinus	fontinalis	885		
Cottus	confusus	4.405	4.412	2
Cottus	bairdii	4.419		
Salmo	trutta	5.643	5.643	3
Morone	saxatilis	5.932	5.932	4
Oncorhynchus	mykiss	3.728	6.143	5
Oncorhynchus	clarkii virginalis	5.402		
Oncorhynchus	tshawytscha	5.950		
Oncorhynchus	kisutch	11.89		
Prosopium	williamsoni	15.72	15.72	6
Hyalella	azteca	23.00	23.00	7
Acipenser	transmontanus	33.79	33.79	8
Ptychocheilus	lucius	46.80	46.80	9

	S^2	13.61
	S	3.689
	L	0.9217
	A	1.746
*regular calculation	FAV	5.734
	CMC	2.9000
	pooled slope	0.9789
	ln (CMI)	-3.443

	S^2	13.61
	S	3.689
	L	0.9217
	A	1.746
FAV*	3.728	*Lowered to protect rainbow trout; this is EPA's 2016 FAV
CMC	1.9000	
pooled slope	0.9789	
ln (CMI)	-3.866	

EPA 2016 Updated Criteria

Duration	Equation*	Standard (µg/L) at Hardness (mg/L)	
		25	400
Acute	NA	--	--
Acute(trout)	$cf_a * e^{(0.9789[\ln(\text{hardness})]-3.866)}$	0.49	6.54
Chronic	$cf_c * e^{(0.7977[\ln(\text{hardness})]-3.909)}$	0.25	2.03

*$Cf_a = 1.136672-[(\ln(\text{hardness}))*(0.041838)]$
$Cf_c = 1.101672-[(\ln(\text{hardness}))*(0.041838)]$

Adapting EPA's Criteria to CO

- **EPA's 2016 cadmium criteria are protective of freshwater aquatic life nationwide**
- **On a statewide basis, it is possible to refine the standards to be protective of specific types of communities**
  - E.g., with or without trout, warm or cold, etc.
  - Acute standard lowered to protect trout is more stringent than necessary to protect Colorado's warm water aquatic life
  - EPA's recommend chronic criterion is protective of all aquatic life, with no Colorado-specific adjustments needed

Proposed Approach

- **The division adjusted EPA's acute criterion to develop a second equation not lowered to protect trout**
  - Same approach used to develop Colorado's current non-trout acute standard
- **However, based on new toxicity data for cold water fish, information about CO's fish communities, and the sensitivity of trout and sculpin, the TAC determined the best approach:**
  - Apply the equation *lowered* to protect trout to all cold waters
  - Apply the equation *not lowered* to protect trout to all warm waters

❖ **Acute(cold) = protective of cold water aquatic life (including trout and sculpin)**

❖ **Acute(warm) = protective of warm water aquatic life**

Proposed Approach

- **This approach ensures protection of all fish in cold waters while not requiring overly stringent standards in warm waters where sensitive cold water species do not occur**
  - Deviates slightly from CO's current framework, which includes an acute standard and an acute(trout) standard
    - The current acute(trout) standard is applied to most, but not all, cold segments
    - Acute(trout) has been omitted on a case-by-case basis where evidence shows trout are not expected to occur. In these limited cases, the acute cadmium standard will now be the standard lowered to protect trout.

Summary: Division Proposal

- **The division proposes to adopt the following cadmium standards for Colorado:**
  - Acute(cold)
  - Acute(warm)
  - Chronic
- **Where**
  - Acute(cold) = EPA's recommended acute criterion, which is lowered to protect trout
  - Acute(warm) is not lowered to protect trout
  - Chronic = EPA's recommended chronic criterion

*at hardness >45 mg/L

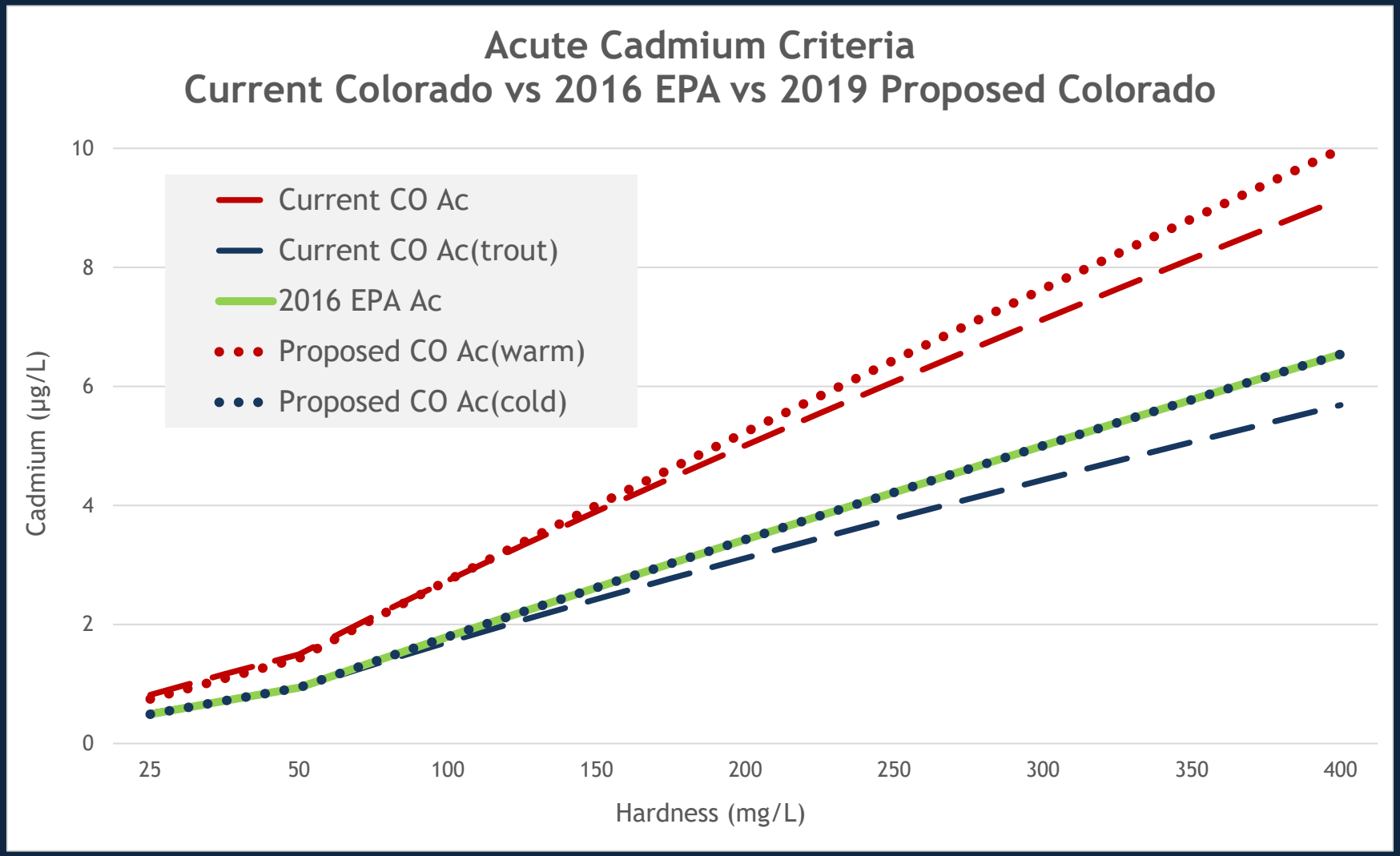
Summary: Division Proposal

Comparison of Colorado's current standards and the division's proposed standards, calculated at a range of hardness values.					
		Standard (µg/L) at Hardness (mg/L)			
Duration	Equation*	25	100	200	400
Current Colorado Cadmium Standards					
Acute	$cf_a * e^{(0.9151[\ln(\text{hardness})]-3.1485)}$	0.82	2.74	5.01	9.15
Acute(trout)	$cf_a * e^{(0.9151[\ln(\text{hardness})]-3.6236)}$	0.51	1.70	3.11	5.69
Chronic	$cf_c * e^{(0.7998[\ln(\text{hardness})]-4.4451)}$	0.15	0.42	0.72	1.20
Proposed Colorado Cadmium Standards					
Acute(warm)	$cf_a * e^{(0.9789[\ln(\text{hardness})]-3.443)}$	0.75	2.74	5.23	9.98
Acute(cold)	$cf_a * e^{(0.9789[\ln(\text{hardness})]-3.866)}$	0.49	1.79	3.43	6.54
Chronic	$cf_c * e^{(0.7977[\ln(\text{hardness})]-3.909)}$	0.25	0.72	1.21	2.03

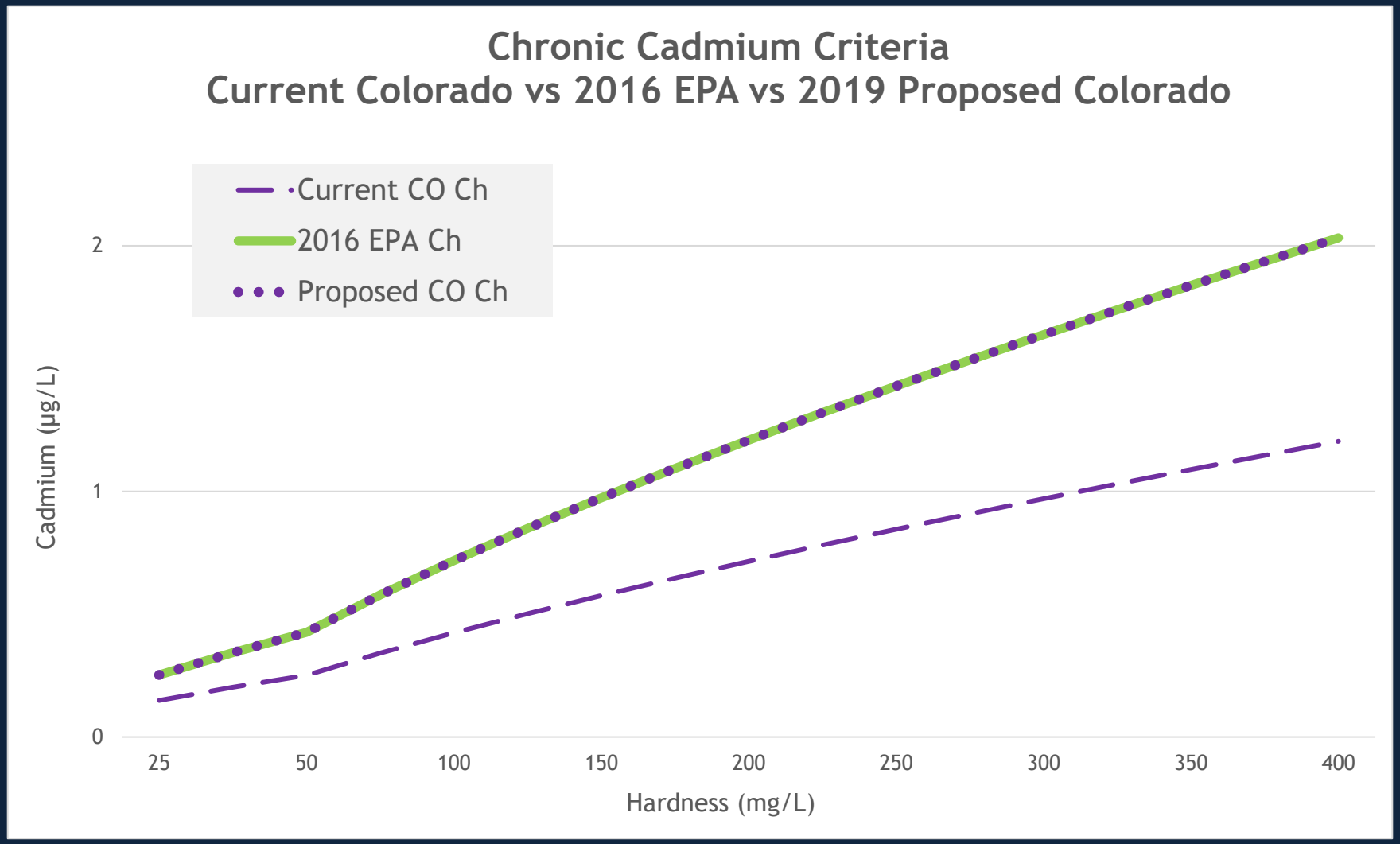
Cf_a = 1.136672-[(ln(hardness))(0.041838)]
Cf_c = 1.101672-[(ln(hardness))*(0.041838)]

*at hardness >45 mg/L

Summary: Division Proposal

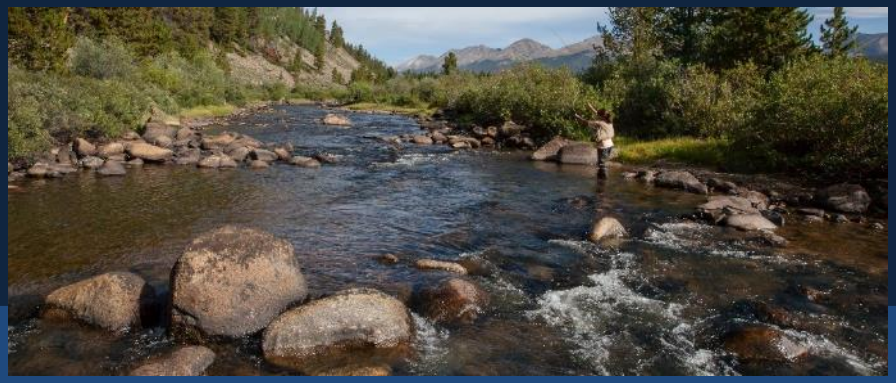


Summary: Division Proposal



Where Changes are Needed

- **Statewide change to TVS requires changes in all of the regulations**
  - Regulation No. 31 Table III (metals) and Table IV (hardness calculation table)
  - Regulation Nos. 32-38 TVS table and footnotes at the front of each basin regulation
- **In the appendix tables**
  - Remove the “tr” qualifier where the acute(trout) equation had applied
  - Replace “SSE*” with “TVS” anywhere the new EPA criteria were adopted early on a site-specific basis



Other Proposed Changes

- **Clarify text in appendix footnotes**
- **Add acronym list to front of appendices**
- **These changes have already been adopted by the commission in Regulation Nos. 33 and 37**
  - June 2019 Regulation Nos. 33 and 37 rulemaking hearing
  - Proposing to update all of the other regulations while they are open at the same time

Thank you to all of the cadmium TAC members!

Jessica DiToro	Leonard Rice Engineers, Inc.
Dan Guth	GEI Consultants, Inc.
Mindi May	Colorado Parks and Wildlife
Dave Moon	U.S. Environmental Protection Agency
Suzanne Pargee	GEI Consultants, Inc.
Kyla Reiner	Colorado Parks and Wildlife


Questions?